DRAWINGS AMENDMENTS:

The attached Replacement Sheets include FIGS. 1-3 replacing all of the originally filed drawings. The Replacement Sheets include no handwritten material.

REMARKS

Reconsideration of this application, as amended, is requested.

Claims 1-7 and 10-28 remain in the application. Claims 1-3, 10 and 24 have been amended. Claims 8 and 9 have been canceled. New claims 26-28 have been added. Claim 1 has been amended to include the limitations of claims 8 and 9 to more clearly define the invention, and therefore, claims 8 and 9 have been canceled. The term "variation" in original claim 9 has been presented in claim 1 as a "stroke". "Stroke" is a more accurate translation of the German term "Tiefenhub" as used in the International Application. New independent claim 28 has been added to include the limitations of claims 1, 8, 10 13, 18 and 21-22. It is respectfully submitted no new matter has been added to the present application.

The Examiner objected to the drawings for containing handwritten element labels.

New drawings have been prepared and are attached hereto. It is respectfully submitted the new drawings are in compliance with 37 CFR 1.121(d) and the objection to the drawings should be withdrawn.

The Examiner objected to the title of the present application because the title "is not descriptive".

The original title has been amended to read as follows: "COHERENCE MICROSCOPE USING INTERFERENCE OF TIME INCOHERENT LIGHT TO ACHIEVE DEPTH RESOLUTION IN A MEASUREMENT SPECIMEN". It is respectfully submitted the objection to the title is overcome.

The Examiner asserted "[t]he abstract of the disclosure is objected to because the specification, in paragraph 0010, refers to the claim by number; this is

inappropriate because the originally filed claim 1, for instance, may not be the same claim 1 upon future amendments". The Examiner also provided suggested guidelines for the layout of the application.

A Preliminary Amendment was filed with the application on June 15, 2005 to enter the changes requested by the Examiner.

Claims 24 and 25 were objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim.

Claim 24 has been amended into independent form. Claim 25 depends from claim 24. It is respectfully submitted the amendments to claim 24 overcome the objection under 37 CFR 1.75(c).

Claims 1-25 were rejected under 35 USC 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the Examiner objected to claims 1,2 and 3 as set forth on pages 5-7 of the Office Action dated June 14, 2007.

Claims 1, 2 and 3 have been amended to overcome the rejection under 35 USC 112, second paragraph and it is respectfully submitted the rejection should be withdrawn.

Claims 1-25 were rejection under 35 USC 103(a) for the reason set forth on pages 7-15 of the Office Action dated June 14, 2007. Claims 1-7 were rejected under 35 USC 103(a) as being unpatentable over Hauger et al (US 2002/0085208) in view of Shultz et al. (US Patent 5,666,195). Claims 8-21 and 23-25 were rejected under 35 USC 103(a) as being unpatentable over Hauger and Shultz as applied to claim 1 above, and further in view of Knupfer et al. (US Patent 6,396,587). Claim 22 was rejected under 35 USC 103(a)

as being unpatentable over Hauger, Shultz, and Knupfer as applied to claim 21 and further in view of Utusi et al. (US Patent (6,788,861).

The coherence microscope of amended claim 1 is directed to a microscope in which interference of time coherent light is used to achieve a depth resolution in a measurement specimen. As is well known, for example from the so-called Michelson interferometer, with coherent light which has been split into two beams which cover paths with different path lengths one can observe an interference pattern depending on the path difference of the two beams after the two beams have been reunited. This interference pattern shows maxima and minima where each maximum represents either no path difference of the two beams or a path difference which corresponds to an integer multiple of the wave length of the coherent light. So, therefore, one would observe maxima at 0λ, 1λ, 2λ, etc. In contrast thereto, if, as in the present invention, time incoherent light is used for interference measurements only a maximum can be observed if both beams cover a path of identical path length before they are reunited, in other words, if the path difference for the two beams is zero. Maxima at integer multiples of the wavelengths of the used light will not be observed with time incoherent light.

In the apparatus disclosed by Knupfer et al. as well as in the present invention such time incoherent light is used. This light is split into a measurement beam and a reference beam. The reference beam is reflected by a mirror and then led through an optical fibre to the sensor line. On the other hand, the measurement beam is reflected from within the specimen and also led to the sensor line through a further optical fibre. The measurement beam and the reference beam are then irradiated from the output ends of the respective optical fibres onto the sensor line. Thereby, each emitted beam forms a light cone so that each beam covers a portion of the sensor line. The path difference of the

two beams meeting on a sensor element depends on their respective path lengths from the output to the optical fibre to the point of the sensor line where both beams meet and from the length of the path of the measuring beam through the specimen. Interference only occurs if the length of the reference beam's path from the fibre output to the sensor element where it meets the measurement beam equals the length of the measurement beam from the fibre output to the sensor element plus the length of the path through the specimen which is determined by the depths from which the measurement beam is reflected within the specimen. Therefore, each point of the irradiated part of the sensor line corresponds to a certain depth of reflection of the measurement beam within the specimen. The range of depth within the specimen which is accessible by the area of the sensor line which is irradiated with the measurement light beam as well as with the reference light beam is the so-called depth variation or depth stroke (in the application the expression depth variation is used instead of depth stroke. However, depth stroke is the more suitable translation of the German expression "Tiefenhub") of the coherence microscope (see page 13, lines 14 to 30 in conjunction with Figure 1).

With the sensor line, a depth stroke can be measured in one measuring step since information about the whole depth stroke is present on the part of the sensor line which is irradiated by the reference beam and the measurement beam. Therefore, the time which is necessary for measuring a whole depth variation or stroke at a given lateral point of the specimen is determined by the time which is necessary to read out the sensor line. Hence, the speed by which the specimen can be rastered laterally depends on the rate by which the sensor line is read out. With a short sensor line or a long sensor line in which only a portion of the pixels are used, i.e. irradiated with the measurement beam and the reference beam, a quick scan of the specimen becomes possible. This is, in particular,

important if a specimen is to be measured in vivo, for example in the eye. The measuring time which is available is limited by the blinking frequency of the eye.

The coherence microscope as claimed in amended claim 1 further comprises a point light source for irradiating the specimen, for example the exit end of an optical fibre, a confocal optics and a confocal aperture. The point light source is imaged onto the specimen by the confocal optics. On the other hand, light reflected from the image area in the specimen is focused in a focal plane of the confocal optics. If, in the focal plane, an aperture is present the orifice of which corresponds to the extent of the focus of the reflected image of the point light source, only such light which is reflected from the image area within the specimen can pass the aperture. Light which is reflected from outside the image area in the specimen is not focused in the plane of the confocal aperture. Therefore, the spot provided by such light is larger than the orifice of the aperture. As a consequence, a large fraction of such light will not pass the aperture. Therefore, by this measure, light from outside the image area of the point light source is blocked by the aperture. However, due to the finite diameter of the orifice the image area not only has a lateral extend but also an extend in the depth of the specimen. The larger the diameter of the orifice the larger the extend in depth. (Note that the image quality decreases with the distance from the focal plane of the confocal optics within the specimen.) In other words, the confocal aperture will block light which emerges from depths within the specimen which differ from the depth over which the image of the point light source extends.

In a usual confocal microscope, the confocal aperture is used to define the depth resolution of the microscope, i.e. the depth zone from which light may pass the aperture. In contrast thereto, in the present invention the depth resolution of the coherence microscope as claimed in the invention depends on the parameters of the used sensor line

and the used light. The orifice of the confocal aperture is chosen large enough so that light of the complete depth stroke can pass the confocal aperture. In other words, the confocal aperture is not used to define depth resolution of the microscope but to ensure that only light reflected from within the depth stroke of the microscope can pass the aperture. By this measure all light emerging from outside the depth stroke will be discarded which improves the measurement.

Knupfer et al. discloses an optical coherence tomography apparatus which already uses a sensor line (33 in Figure 1) as in the present invention. It further describes the operation of such an apparatus. A similar coherence microscope is disclosed by Hauger et al. However, Knupfer et al. do not describe using a short sensor line or "a sensor line (41) including a predetermined number of sensor elements for detecting the light resulting from the superimposition, the predetermined number of sensor elements being selected so a read-out rate of at least 60kHz is achieved". Although Knupfer et al. and Hauger et al. already disclose a coherence microscope using a sensor line, they do not disclose using a microscope with a confocal aperture the orifice of which is chosen such that the depth extent of the confocal zone substantially corresponds to the depth variation or stroke of the coherence microscope. Furthermore, Shultz et al. do not disclose coherence microscopes using sensor lines. Although Shultz et al. describes a sensor line in column 7, lines 20 to 24, this sensor line is not used in the same manner as in the inventive coherence microscope of amended claim 1. Instead Shultz et al. describe an interferometric instrumentation in which light having a long coherence length is used and the sensor line is used for detecting the zero order, first order, second order, etc. maximum of a fringe pattern (compare column 5, lines 42 to 63).

Therefore, it is respectfully submitted amended claim 1 is not obvious to one having skill in the art at the time the invention was made since at that time is was common to set confocal apertures such as to determine the depth resolution of a confocal microscope. However, a confocal aperture is not used in such a conventional way in the invention as claimed in claim 1. Furthermore, claims 2-7, 10-23 and 26-27 depending directly or indirectly from amended claim 1 are patentable at least one the same reasons put forth for claim 1 and are in condition for allowance.

Amended claim 24 is directed to a method using a coherence microscope as defined in amended claim 1. For at least the reasons set forth above in relation to claim 1, claim 24 is patentably distinct and not rendered obvious by any combination of the references of record, and therefore, is in condition for allowance along with dependent claim 25.

New claim 28 defines a coherence microscope that allows for a very fast scanning of a specimen. Due to the linear arrangement of the fibre bundle's proximate fibre ends and the use of a rotatable polygonal mirror for coupling light into and out of the fibres of the fibre bundle only one moveably element, namely the rotatable mirror, is necessary to perform a scan. If the distal ends of the fibre bundle's fibres are arranged in a two-dimensional array, as shown in Figure 3, one can realize a fast lateral scan in two dimensions with only one moving element. This is described in the present application on page 18, line 18 to page 19, line 7.

Indeed, Utsui et al. disclose an endoscope with an optical coherence tomography system comprising an ordered fibre bundle and a polygonal mirror (see Figure 3 together with column 9, lines 55 ff). However, in contrast to the present invention as defined in claim 28, the polygonal mirror disclosed by Utsui et al. is located at the distal

end of the endoscope. Moreover, the polygonal mirror of Utsui et al. is used to reflect light from an optical fibre F1 which is not identical with the fibre bundle 12b of the endoscope (see column 4, lines 63 to 61). Actually, the fibre bundle 12b does not even belong to the OCT section 23, as can be seen from Figure 1 in conjunction with column 7, line 66 to column 9, line 54. Therefore, it cannot be rendered obvious by Utsui et al. to locate a polygonal mirror at the proximal end of a fibre bundle of a coherence microscope for coupling light into the fibre bundle and out from the fibre bundle. In addition, neither of the cited documents discloses a fibre bundle in which the proximal ends of the fibres are arranged linearly.

Accordingly, it is submitted that the claims remaining in the application are directed to patentable subject matter, and allowance is solicited. The Examiner is urged to contact applicant's attorney at the number below to expedite the prosecution of this application.

Respectfully submitted,

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